Section 627—Mechanically Stabilized Embankment Retaining Wall—Contractor Design

627.1 General Description

This Specification covers the required materials, fabrication, construction, measurement, and payment for Contractor designed Mechanically Stabilized Embankment (MSE) retaining walls.

The scope of work of wall erection includes:

- Grading for wall construction
- Compacting the wall foundation
- General and local dewatering as required
- Constructing leveling pads
- Erecting precast panels
- Placing soil reinforcing devices
- Placing and compacting special embankment backfill within the reinforced volume
- Furnishing and placing precast or cast-in-place concrete coping and cast-in-place or precast traffic barrier on top of the wall if shown on the Plans
- Providing downdrag protection for piles
- Furnishing and placing precast or cast-in-place concrete coping and precast or cast-in-place traffic barrier on the top of the wall if these items are shown in the Plans.

The wall foundation includes areas underlying the leveling pad and the reinforced volume. Ensure that items used to construct the mechanically stabilized embankment retaining walls but not mentioned in this Specification conform to the applicable sections of the Standard Specifications.

For patented mechanically stabilized embankment retaining walls, obtain panels, soil reinforcing devices, connecting devices, joint materials, attachments, and expertise to construct the walls.

627.1.01 Definitions

Wall foundation—the area underlying the leveling pad and the reinforced volume.

627.1.02 Related References

A. Standard Specifications

Section 106—Control of Materials

Section 208—Embankments

Section 500—Concrete Structures

Section 511—Reinforcement Steel

Section 514—Epoxy Coated Steel Reinforcement

Section 535—Painting Structures

Section 645—Repair of Galvanized Coatings

Section 812—Backfill Materials

Section 848—Pipe Appurtenances

Section 865—Manufacture of Prestressed Concrete Bridge Members

Section 870—Paint

B. Referenced Documents

GDT 75

1992 AASHTO Specifications for Highway Bridges, Section 18, Elastomeric Bearings

627.1.03 Submittals

Submit construction drawings and design notes to the Engineer for review and approval. The submission shall be prepared and stamped by the Design Engineer who shall be registered as a Professional Engineer in the State of Georgia.

Include in the submission, design notes and reproducible drawings concerning the following:

A. Details, dimensions, and schedules of all reinforcing steel, including dowels and/or studs for attaching the facing to the backfill reinforcement.

B. Details of backfill stabilizing devices including the length, spacing and size and type material.

C. For MSE Walls at Bridge Ends:

- Ensure that MSE wall backfill extends vertically to the bottom of the approach slab.
- Ensure that the MSE wall backfill extends horizontally to the back of the MSE backfill for the wall below the approach slab or 12 inches (300 mm) beyond the end of the stabilizing devices attached to the bridge, whichever is greater.
- Show details of attachments to be cast into the bridge endbent, endwall and backwall.
- Do not make attachments to bridge endwalls that are integral to the bridge superstructure and are subject to movement due to superstructure expansion and contraction.

D. Use Traffic barrier H, and Cast-in-place Coping B whenever noise walls, light standards, or any other appurtenance is mounted on top of the barrier or coping.

Use Traffic barrier Vand Cast-in-place Coping A when no appurtenance is used on top of the barrier or coping.

Traffic barriers shall be cast in place, except that traffic barrier H shall be precast when detailed as precast on the Plans.

E. Ensure that Plans match GDOT plans in size, format, borders, title block, etc.

F. Prepare the Plans in “microstation.dgn” format.

G. Itemize the wall quantities as follows:

1. Wall Envelope quantities in the Plans.
2. Changed quantities based on the survey verification of the Wall Envelope (Adjusted Wall Envelope).

The time required for preparation and review of plans and calculations will be charged to the allowable contract time. The final plans and calculations for a wall shall be approved prior to beginning construction on the wall.

The Department will be allowed 45 days to review the plans and calculations and provide either approval or review comments to the contractor. The 45-day review time will begin when the Department has received all of the calculations and drawings concerning the structure. Each new submittal from the Contractor as a result of corrections resulting from the Department's review or changes that are made by the contractor to expedite construction or to correct for field errors will have a 45 day review time.

The Department will be the sole judge of the adequacy of the information submitted. The review and acceptance of the final plans and methods of construction by the Department will not in any way relieve the Contractor of responsibility for the successful completion of the work. Contractor delays due to untimely submissions and insufficient information will not be considered as justification for time extensions.

Within 30 days of receiving Department approval of the plans, submit “stamped” reproducible mylar originals for inclusion in the project plans. Also, submit Electronic files of the final plans. For any changes made during construction of the wall, submit “as built” reproducible mylar originals and “as built” electronic files.

627.2 Materials

For Tensar walls see Section 626.2, “Materials” and Section 809 of the Specifications.

For Reinforced Earth, Retained Earth and GASE walls see Subsection 626.2, “Materials” of the Specifications.

627.3 Construction Requirements

627.3.01 Personnel

Meet the following personnel requirements:

A. Design

Use a Design Engineer with the following qualifications to design the wall and prepare and submit plans for approval:

- Is a registered as a Professional Engineer in the State of Georgia.

- Has knowledge and experience with the design and construction of MSE walls.
- Is available at any time during the life of the Contract to discuss the design of the walls directly with the Department.

B. Construction

The Contractor or Subcontractor shall meet the following requirements:

- Be experienced in the construction of Mechanically Stabilized Embankment Walls.
- Include on staff, a supervising engineer for the Project with at least five years of experience in the construction of Mechanically Stabilized Embankment Walls.

Submit the following proof, whenever requested by the Department, of the ability to design and/or construct Mechanically Stabilized Embankment Walls.

- Evidence of the successful completion of at least five Projects similar in concept and scope to the proposed wall.
- Resumes of the supervising engineer and foremen to be employed on this Project showing the type and number of Mechanically Stabilized Embankment Walls each worked on within the past five (5) years.

The Department will be the sole judge of the acceptability of the qualifications of the design engineer, supervising engineer and foreman.

627.3.02 Equipment

General Provisions 101 through 150.

627.3.03 Preparation

A. General Requirements – Designing and Detailing

The Department's plans will include a Wall Envelope. The Wall Envelope will show:

- The existing and proposed ground line,
- The maximum elevation of the top of the leveling pad
- The proposed top of coping or the proposed gutterline elevations where the barrier is attached to the wall
- The soil parameters for the wall design
- The location of any internal walls required
- The location of other appurtenances including but not limited to:
  --Light standards
  -- Sound barriers
  --Sign supports
- Other obstructions in the wall backfill including but not limited to:
  -- Drainage structures and pipes
  -- Bridge columns, caps, wingwalls
  -- Bridge piles
- Details of any proposed ditches at the top of the wall
- Proposed pay quantities

Ensure that the wall design is compatible with all horizontal and vertical criteria and backfill loading conditions.

Verify the wall location according to Subsection 149.1.03.E and Subsection 149.3.03.D before the final wall design is submitted. Include in the verification:

- The top and bottom of the wall envelope
- Backfill design conditions
- Depth of wall embedment
- Location of drainage structures and other obstructions in the wall backfill
- Other appurtenances located on the wall.

If any changes to the wall envelope are required by the field survey, submit plan sheets to the Engineer for approval showing the wall envelope as detailed in the plans with the required changes noted.

B. Wall Design

Use the following design criteria for a Contractor designed wall:

1. Provide one of the following wall systems:
   - Georgia Stabilized Embankment (GASE)
   - Reinforced Earth Wall* (The Reinforced Earth Company)
   - Retained Earth Wall* (Foster Geotechnical)
   - ARES* (Tensar Earth Technologies)
2. Design the MSE Wall according to the current AASHTO Standard Specifications for Highway Bridges including interims. (Mechanically Stabilized Earth Wall Design – Section 5.8)
3. Design the GASE wall system using the Mechanically Stabilized Embankment Wall program that is available from FHWA. Upon request, the Department's Office of Bridge Design will provide GASE wall detail sheets to prospective bidders for use in preparing the wall plans.
4. Design the MSE wall to account for all live load, dead load and wind load from all traffic barrier, lights, overhead signs, sound barriers and other appurtenance located on top and adjacent to the wall. Design MSE walls to account for all external forces. Also, design abutment walls for all horizontal and vertical loads applied by the bridge.
5. Assume responsibility for all temporary shoring that may be necessary for wall construction. Design the shoring using sound engineering principles.
6. Use permanent concrete wall facing panels that are at least 7 in (175 mm) thick.
7. Provide a minimum length of soil reinforcement of 10 feet (3 m) or seven-tenths (0.7) of the wall height, whichever is greater.
8. Ensure that the special wall backfill extends a minimum of 12 in (300 mm) past the end of the soil reinforcement.
9 Use the Architectural treatment of facing panels as indicated on the Department's drawings.
10. Provide internal walls to allow for future widening if shown on the wall envelope. Ensure the internal walls have galvanized wire or concrete facing. Ensure as a minimum, that the facing of the internal walls extend to the back limit of the MSE Wall Backfill for the permanent wall.
11. Ensure the maximum panel area does not exceed 35 square feet (3.25 square meters).
12. Design the barrier for a 500 lbs. per linear foot (744 kilograms per linear meter) loading applied horizontally along the top of the barrier. The barrier shall be continuous or have counterweight slab continuous over not less than four panels.
13. A Foundation Investigation Report may be available from the Geotechnical Engineering Bureau of the Department. The information contained in this report may be used by the Contractor to assist in evaluating existing conditions for design as well as construction. However, the accuracy of the information is not guaranteed and no requests for additional monies or time extensions will be considered as a result of the Contractor relying on the information in this report.
14. Ensure the following requirements are met:
    - The gutterline grade on the proposed top of wall submitted matches the gutter elevations required by the plans.
    - The top of coping is at or above the top of coping shown on the envelope.
    - The leveling pad is at or below the elevation shown on the wall envelope.
    - Any changes in wall pay quantities due to changes in the wall envelope are noted in the contractor's plans
    - All changes in quantities due to the proposed walls being outside the wall envelope (step locations, ending wall at full panel, etc.) are shown as separate quantities.
15. Ensure the minimum embedment of the wall (top of leveling pad) is at least 2 feet (600 mm). If the soil slopes away from the bottom of the wall, lower the bottom of the wall to provide a minimum horizontal distance of 10 ft (3 m) to the slope. [i.e. a 2:1 slope in front of the wall requires 5 ft (1.5 m) of embedment; a 4:1 slope in front of the wall requires 2.5 ft (750 mm) of embedment]
16. If the Department's review of the submitted plans and calculations results in more than two submittals to the Department by the Contractor, the Contractor will be assessed for all reviews in excess of two submittals. The assessment for these additional reviews will be at the rate of $60.00 per hour of engineering time expended.

627.3.04 Fabrication

For Tensar, Reinforced Earth, retained Earth and GASE walls see Subsection 626.3.04 of the Specifications.

627.3.05 Construction

For Tensar, Reinforced Earth, Retained Earth and GASE walls see Subsection 626.3.05 of the Specifications.

627.3.06 Quality Acceptance

General Provisions 101 through 150.

627.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

627.4 Measurement

A. Excavation and Shoring

Excavation, including any required removal of unstable material, and shoring necessary for construction of the MSE Wall will not be measured for payment.

B. MSE Wall Face

The area of wall face, complete in place and accepted, will be designated for payment by the square foot (meter) for each height. The area of drains through the Wall will not be deducted.

The wall area measured for payment will be the area from the proposed top of coping or the proposed gutterline or top of sidewalk elevations to the maximum elevation of the top of the leveling pad for each height wall.

Any area of cast-in-place facing around drainage structures within the approved wall envelope will be measured as MSE Wall Face. “Dummy” panels will not be measured for payment.

No separate measurement will be made for internal wall facing.

The entire vertical section of wall will be measured for the greatest height within each section. (i.e. The entire envelope area of a 25 ft (7.62 m) long section of wall that measured from 12 ft (3.66 m) high to 18 ft (5.5 m) high will be measured for payment as MSE Wall Face, Wall No. _ [>10’-20’ (3 – 6 m) ht].

The height will be measured from the maximum elevation of the top of the leveling pad to the:

1. Top of Coping or,
2. Gutterline Elevation at the Barrier or,
3. Top of Sidewalk at Parapet

C. Backfill Stabilizing Devices

The backfill stabilizing devices will not be measured separately.

D. Backfill

The MSE backfill material used in the MSE wall volume will not be measured separately except as noted below.

- The MSE Backfill required behind bridge endwalls or backwalls and above the top of coping will be measured as additional MSE wall backfill.
- Any additional MSE backfill required as a result of an undercut ordered by the Engineer and requiring the MSE backfill material to provide stability, as determined by the Engineer, will be measured and paid for as additional MSE wall backfill.

Backfill of undercut areas not requiring classes of soils higher than common excavation soils will not be measured separately.

Backfill material required by construction procedures to extend outside the MSE wall volume shall be considered incidental and will not be measured separately.

E. Concrete Leveling Pads

Concrete Leveling Pads will not be measured separately.

F. Cast-in-place Coping A, Cast-in-place Coping B, Precast Coping, Traffic Barrier V, Traffic Barrier H, mounted atop the MSE Wall

These units complete in place and accepted, will be designated on the Plans and measured per linear foot (meter) for each type unit.

The quantities of coping and barrier will be measured as horizontal lengths in linear feet (meters).

627.4.01 Limits

General Provisions 101 through 150.

627.5 Payment

The pay quantities will be the Wall Envelope quantities shown in the Plans unless the Engineer approves an adjusted wall envelope. In this case, the pay quantities will be the adjusted wall envelope quantities.

No additional compensation will be made for any additional material, equipment, design, or other items found necessary to comply with the project Specifications as a result of the Department's review except for changes made necessary by the survey verification required by Subsection 149.1.03.E and Subsection 149.3.03.D, or other changes approved by the Engineer.

Include in the unit bid prices all costs necessary to comply with the requirements of this specification. No payment will be made for wall area outside of the adjusted wall envelope.

A. Excavation and Shoring

Excavation, including removing unstable material and shoring for construction of the mechanically stabilized embankment retaining wall, will not be paid for separately.

B. MSE Wall Face

The area of wall face, complete in place and accepted, will be paid for by the square foot (meter) for each height. The area of drains through the wall will not be deducted.

Any area of cast-in-place facing around drainage structures within the approved wall envelope will be paid as wall face. Payment will include all costs for concrete, reinforcing steel in the cast-in-place areas. No additional payment will be made for any “dummy” panels required.

If the wall height changes to a height greater than the maximum included in the pay items, the area of wall with a height greater than the maximum will be paid at 120% of the bid price of the maximum height pay item included in the plans.

The entire vertical section of wall will be paid at the unit price for the greatest height within each section. (i.e. The entire envelope area of a 25 foot (7.62 m) section of wall that measured from 12 ft (3.66 m) high to 18 ft (5.5 m) high will be paid as MSE Wall Face, Wall No. _ [>10’-20’ (3 – 6 m) ht]

No separate payment will be made for architectural treatment.

No separate payment will be made for internal wall facing, internal wall backfill stabilizing devices or additional MSE backfill necessitated by the internal wall.

C. Backfill Stabilizing Devices

The backfill stabilizing devices will not be paid for separately. Include this cost in the unit price bid for MSE wall face.

D. Backfill

The MSE backfill material used in the MSE wall volume will not be paid for separately except as noted below. When not paid for separately, include the cost in the unit price bid for MSE wall face.

Exceptions:

- The cost of MSE Backfill required behind bridge endwalls or backwalls and above the top coping will be paid for as Additional MSE Wall Backfill.
- Any additional MSE backfill required as a result of an undercut ordered by the Engineer and requiring the MSE backfill material to provide stability, as determined by the Engineer, will be paid as additional MSE wall backfill.
- If no quantities for this item are included in the proposal, a price of $25 per cubic yard ($33.00 per cubic meter) will be paid.

Backfill of undercut areas not requiring materials of grades higher than common excavation soils will not be paid for separately. Include the cost in the overall bid price submitted.

Any backfill material required by construction procedures to extend outside the MSE Wall volume is considered incidental. Include this cost in the price bid for contract items.

E. Concrete Leveling Pads

Concrete leveling pads, including steps shown in the Plans will not be paid for separately.

F. Cast-in-place Coping A, Cast-in-place Coping B, Precast Coping, Traffic Barrier V, Traffic Barrier H, mounted atop the MSE Wall

These units, complete in place and accepted, will be designated on the Plans and paid for at the Contract Unit Price bid per linear foot (meter) for each type unit.

G. Dewatering

No separate payment will be made for dewatering. Include the cost of dewatering in the price bid for special embankment backfill.

Payment will be made under:

Item No. 627	MSE wall face, wall No. __0 -10 ft (0 -3 m)	Per square foot (meter)
Item No. 627	MSE wall face, wall No. __>10 -20 ft (3 -6 m)	Per square foot (meter)
Item No. 627	MSE wall face, wall No. __>20- 30 ft (6 -9 m)	Per square foot (meter)
Item No. 627	MSE wall face, wall No. __>30 ft (6 -9 m)	Per square foot (meter)
Item No. 627	Coping, A, wall No. ___	Per linear foot (meter)
Item No. 627	Coping, B, wall No.___	Per linear foot (meter)
Item No. 627	Traffic barrier, H, wall No.___	Per linear foot (meter)
Item No. 627	Traffic barrier, V, wall No.___	Per cubic yard (meter)
Item No. 627	Additional MSE backfill	Per cubic yard (meter)

627.5.01 Adjustments

General Provisions 101 through 150.

Section 631—Permanent Changeable Message Signs

631.1 General Description

Specifications for this work will be included elsewhere in the Contract.

Section 632—Portable Changeable Message Signs

632.1 General Description

This work includes furnishing, maintaining, transporting, and using Portable Changeable Message Signs according to these Specifications at locations shown on the Plans, in the Special Provisions, or as directed by the Engineer.

632.1.01 Definitions

General Provisions 101 through 150.

632.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.